CLAIMS

1. A method of producing at least one porous bead, which comprises the steps of

(a) Providing a first liquid phase comprising a bead matrix material and at least one essentially edgy templating particle, said particle(s) being treated with a surface modifying agent;

(b) Providing a second liquid phase which is immiscible with the first liquid phase;

(c) Contacting the first phase and the second phase under conditions resulting in an emulsion of droplets comprised of the first liquid phase dispersed in the continuous second liquid phase;

(d) Transforming the droplets to mesoporous beads by solidification of the liquid in said droplets; and

(e) Removing the templating particle(s) from the beads without causing any essential change of the surrounding bead, whereby the mesoporous beads resulting from step (d) are supplemented with one or more larger pores corresponding to the cavities left by the removed templating particle(s);

whereby an essentially hierarchical network of pores is provided in each bead.

2. A method according to claim 1, wherein a surface modifying agent is present in the first liquid phase when the templating particle(s) are added therein.

3. A method according to claim 1, wherein the templating particle(s) are treated with a surface modifying agent before they are added to the first liquid phase.

4. A method according to any one of the previous claims, which further comprises a step of diluting the droplet phase before step (c).

5. A method according to any one of the previous claims, which further comprises a step of removing liquid from the droplet phase after step (c) but before step (d).

6. A method according to any one of the previous claims, wherein the concentration of the templating particle(s) in the droplet phase is close to the percolation threshold during the solidification.

7. A method according to any one of the previous claims, wherein the shape of the templating particle(s) is elongate and defined by an aspect ratio higher than two, preferably higher than five.
8. A method according to any one of the previous claims, wherein the shape of the templating particle(s) is edgy and defined by a sphericity lower than about 0.8, preferably lower than about 0.6.
9. A method according to any one of the previous claims, wherein the shape of the templating particle(s) is edgy and defined by a circularity of the particle projection(s) lower than about 0.85, preferably lower than about 0.6.
10. A method according to any one of the previous claims, wherein the templating particle(s) are acid-soluble and made from a material selected from the group that consists of carbonate minerals, oxide minerals, calcium phosphate, magnesium hydroxide, and metals.
11. A method according to claim 10, wherein the templating particles are removed by leaching with an acid.
12. A method according to any one of claims 1-9, wherein the templating particle(s) are siliceous particles and made from a material selected from the group that consists of silica, diatomite, glass, and silicate minerals.
13. A method according to claim 12, wherein the templating particles are removed by leaching with a fluorine compound.
14. A method according to any one of claims 1-9, wherein the templating particle(s) are organic or carbonaceous particles and made from a material selected from the group that consists of organic polymers, low molecular weight organic crystals and carbon.
15. A method according to any one of claims 1-9, wherein the templating particle(s) are alkali-soluble particles and made from a material selected from the group that consists of siliceous particles, metal particles and oxides, such as alumina.
16. A method according to claim 14 or 15, wherein the templating particles are removed by leaching with a base.

17. A method according to any one of the previous claims, wherein the templating particles are volatilised by heat treatment, optionally in the presence of air or oxygen.
18. A method according to any one of the previous claims, wherein the droplet phase of the emulsion is comprised of oil droplets.
19. A method according to claim 18, wherein the bead matrix material is comprised of synthetic monomers and the transformation according to step (d) is a polymerisation in the presence of a porogen and a cross-linker.
20. A method according to any one of claims 1-17, wherein the droplet phase of the emulsion is comprised of aqueous droplets.
21. A method according to claim 20, wherein the bead matrix material is comprised of a natural polymer and the transformation according to step (d) is a physical gelation.
22. A method according to claim 20, wherein the aqueous droplets comprise an inorganic compound and the transformation according to step (d) is a sol-gel precipitation.
23. A separation matrix comprised of porous beads produced according to any one of claims 1-22, wherein each bead comprises a network of hierarchical pore sizes.
24. A separation matrix or catalyst support comprised of porous beads produced according to any one of claims 1-22, wherein the beads have an ellipsoidal shape with an aspect ratio > 1.2, preferably > 1.5.